

## TITLE OF THE INVENTION

## CONTAINER PLUG ATTACHING DEVICE

## BACKGROUND OF THE INVENTION

*It's A P* The present invention relates to a container plug attaching device for use with containers, such as cartons to be filled with sake or the like, for attaching a plug to an edge portion of the container defining an outlet thereof.

As disclosed, for example, in the publication of JP-A No. 10-77012, devices of the type mentioned are already known which comprise two anvils, a horizontal rotary shaft having mounted thereon the two anvils as spaced apart from each other by 180 degrees and projecting radially of the shaft, drive means for driving the rotary shaft intermittently through 180 degrees at a time so as to stop the two anvils alternately in a downward sealing posture and an upward supply posture, a sealing member to be opposed to the anvil as stopped in the sealing posture, and a chute for supplying a plug to the anvil as stopped in the supply posture.

Since the conventional device described has two anvils, the two anvils need to be adjusted individually so that each anvil will be stopped accurately in both the sealing posture and the supply posture. However, the

adjusting work is cumbersome and requires much time.

#### SUMMARY OF THE INVENTION

An object of the present invention is to provide a container plug attaching device wherein an anvil or anvils  
5 are adjustable easily within a short period of time.

The present invention provides a container plug attaching device for attaching to an edge portion of a container defining an outlet thereof a tubular plug having an opening at one end and a flange around an edge portion  
10 defining the opening, the device having an anvil and a sealing member for clamping therebetween the container edge portion and the flange as pressed against the container edge portion for sealing, the container plug attaching device being characterized in that at least one  
15 anvil is mounted on a rotary shaft so as to project radially thereof, the rotary shaft being intermittently drivable by drive means so as to stop the anvil in a sealing posture, anvils being equal in number to the number of sealing postures when provided and to the number  
20 of sealing members, the sealing member or each of the sealing members being positionable as opposed to a clamping face of the anvil or each of the anvils as halted in the sealing posture.

With the container plug attaching device of the  
25 present invention, only one anvil is used for one sealing

member, and the anvil needs only to be stopped in one sealing posture. The anvil is therefore adjustable easily within a short period of time.

The drive means is so controlled as to stop the anvil  
5 only in the sealing posture, and the plug is supplied to the anvil in rotation. Since the anvil needs to be stopped only when it is in the sealing posture, the anvil is adjustable with greater ease.

The drive means may be so controlled as to stop the  
10 anvil in a supply posture different from the sealing posture. The plug is supplied to the anvil as stopped in the supply posture.

The clamping face of the anvil is provided with an engaging projection for fitting the plug thereover, and  
15 supply means has a plug transport member having a delivery opening opposed to a path of movement of the projection for transporting the plug with the end opening thereof facing toward the same direction as the delivery opening.

The plug transport member is provided with delivery means  
20 for pushing out the plug from the delivery opening so as to fit the plug over the projection as moved to the position of the delivery opening. The plug can then be supplied to the anvil during rotation.

The delivery means has a pushing-out member movable  
25 through the delivery opening toward or away from the path

of movement of the projection, and the pushing-out member has a plug suction face opposed to the path of movement of the projection. The suction face is so shaped as to gradually approach the path of movement of the projection

5 from an upstream side thereof with respect to the path toward a downstream side thereof. The distance between the clamping face of the anvil and the path downstream side of the suction face of the pushing-out member as moved toward the path is equal to the height of the plug.

10 The plug can then be engaged with the projection in movement by utilizing the movement of the projection, thereafter rotated and thereby reliably fitted over the projection.

The rotary shaft extends horizontally, the anvil is

15 directed downward when in the sealing posture, and a container transport conveyor is provided at a level below the rotary shaft and has a container transport path extending in a direction transverse to the rotary shaft and joining a lower end of the path of movement of the

20 projection. The anvil and the conveyor are driven in synchronism so as to insert an outer end of the anvil as moved toward the sealing posture into an upper-end opening of the container and to position the container edge portion between the projection of the anvil in the sealing

25 posture and the sealing member. The container then need

not be moved up and down for attaching the plug to the container. An increased length of time is therefore available for sealing during the cessation of transport.

The anvil has a base end portion fixed to the rotary shaft and an outer end portion provided with plug holding means, and the outer end portion is offset from the base end portion axially of the rotary shaft by a distance greater than the distance corresponding to the thickness of the base end portion. For example when two anvils are used for transporting two containers by two pitches at a time, the two anvils can then be so arranged that the outer end portion of one anvil is positioned alongside the base end portion of the other anvil to juxtapose these end portions axially of the rotary shaft, whereby the pitch of anvils arranged can be diminished.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in vertical cross section showing an arrangement including a plug attaching device according to the invention;

FIG. 2 is a view in vertical longitudinal section taken along the line II-II in FIG. 1;

FIG. 3 is a perspective view of an anvil and a pushing-out member of the device;

FIG. 4 includes diagrams for illustrating containers and the anvil as moved by the device;

FIG. 5 includes diagrams for illustrating the anvil and the pushing-out member as moved by the device;

FIG. 6 is an exploded perspective view of the container and a plug for use with the device;

5 FIG. 7 is a plan view of a plug attaching device of another embodiment;

FIG. 8 includes diagrams for illustrating the operation of the device;

10 FIG. 9 is a perspective view of an example of modified anvil; and

FIG. 10 is a perspective view of anvils as another modification.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be described 15 below with reference to the drawings.

In the following description, the term "front" refers to the direction in which the container on the conveyor advances (as indicated by an arrow in FIGS. 1 and 2), and the term "rear" to the opposite direction. The terms 20 "left" and "right" refer respectively to the left and right sides of the device as it is seen from behind forward (i.e., the left-hand side and right-hand side of FIG. 1).

FIG. 6 shows in detail the container C and the plug P 25 for use with the device embodying the invention.

The container C is made of a paper-base laminate having a polyethylene layer over each of its opposite surfaces and in the form of a tube having a bottom and rectangular to square in cross section. The container C  
5 has a circular outlet O formed in the center of a rectangular top panel for providing a top T.

The plug P comprises a plug body M and a cap K each molded integrally from a thermoplastic resin.

The plug body M comprises a cylindrical trunk wall L,  
10 and an annular flange F formed at the lower end of the wall. The trunk wall L is provided with a male screw Sm formed on its outer surface.

The cap K has a skirt S so sized as to be insertable loosely through the outlet O. The skirt S is provided on  
15 its inner surface with a female screw (not shown) screwed on the male screw Sm. The cap K as fitted around the trunk wall L is fitted into the outlet O from inside the container C.

FIG. 1 shows a conveyor 11 for transporting containers  
20 C forward, and a plug sealing device 12 for attaching the plug P to the container C to be transported by the conveyor 11.

The conveyor 11, which is an intermittently drivable chain conveyor, comprises a pair of horizontal endless  
25 chains 21, holders 22 arranged on the chains 21 at a

predetermined spacing for holding containers C while rendering the containers free to move upward or downward, and a horizontal guide rail 23 disposed below the path of movement of the container for supporting the bottom of the 5 container C thereon for guiding.

The container C is held by the holder 22, with its top T projecting upward and with its outlet O facing toward the right. The chains 21 are intermittently driven so as to stop the containers C one after another at a sealing 10 station.

The plug sealing device 12 comprises a horizontal rotary shaft 31 extending from left to right transversely of the path of transport of the container with its right end projecting to above the path, an armlike anvil 33 attached to the right end of the shaft 31 to project radially thereof and having a vertical clamping face 32 facing rightward, a vertical plug chute 35 provided at its lower end with a delivery opening 34 opposed to the clamping face 32 of the anvil 33 as positioned in a 20 vertical upward supply posture, and an ultrasonic sealer 37 having a sealing member 36 and opposed to the clamping face 32 of the anvil 33 as positioned in a downward sealing posture.

The rotary shaft 31 is supported by bearings 41 on a 25 movable body 42 in the form of a horizontal plate and

movable transversely of the container transport path. The movable body 42 is supported by slide guide members 43 on horizontal guide rails 44 extending in the transverse direction. Connected to the left end of the movable body 5 42 is the piston rod of a first fluid pressure cylinder 45 directed toward the right.

A driven sprocket 51 is fixed to the left end of the rotary shaft 31. A belt 54 is reeved around the driven sprocket 51 and a drive sprocket 53 fixed to the output 10 shaft of a servomotor 52.

As shown in detail in FIG. 3, the anvil 33 is in the form of an arm extending straight and has a projection 61 at the outer end of the clamping face 32. The projection 61 has an outer periphery so sized as to permit the trunk 15 wall L of the plug P to fit therearound snugly. The projection 61 is positioned as opposed square to the chute delivery opening 34 when the anvil 33 is in its vertical upward supply posture.

The chute 35 contains plugs P as arranged in a 20 vertical row with the openings of their truck walls L facing leftward. A pushing-out member 62 and a cutting member 63 are arranged in the vicinity of the delivery opening 34 of the chute 35. A guide member 64 (FIG. 2) is joined to a chute rear end portion around the opening 34.

25 The pushing-out member 62 is in the form of a

horizontal rod having a vacuum head 71 at its left end and extending transversely of the container transport path. The pushing-out member 62 is connected to the piston rod of a second fluid pressure cylinder 72 directed leftward 5 so as to move the vacuum head 71 into or out of the delivery opening 34 across the chute 35.

*This P27* With reference to FIGS. 3 and 5, the vacuum head 71 is in the form of a generally vertical elliptical plate and has a suction face 73 facing leftward. The suction face 10 73, which is a vertical flat face, deflects gradually leftward as it extends from the front rearward, thus facing toward a leftwardly forward oblique direction. The suction face 73 is provided at its front edge with a positioning ridge 74 having a circular-arc cross section. 15 The ridge 74 has a side face 75 facing rearward, circular-arc in cross section to position along the outer periphery of the cap K of the plug P and orthogonal to the suction face 73. A suction hole 76 is formed in the center of the suction face 73. With the clamping face 32 of the anvil 20 33 opposed to the delivery opening 34 of the chute 35, the distance between the clamping face 32 and the suction face 73 gradually decreases from the front toward the rear, and the distance G [FIG. 5(d)] between the clamping face 32 and the rear edge of the suction face 73 is slightly 25 greater than the height of the plug P. The distance G is

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equal to the distance between the left guide face of the guide member 64 and the clamping face 32.

As shown in detail in FIG. 2, the cutting member 63 comprises a forward upper engaging round rod 81 and a 5 rearward lower engaging round rod 82 which are interconnected by a connecting bar 83 and alternately engageable with or disengageable from the plug P at a position one above the lowermost plug P within the chute 35 and the plug P overlying the former plug P. The 10 cutting member 63 is movable forward and rearward by a rodless third fluid pressure cylinder 84.

When the cutting member 63 is moved rightward and leftward by the operation of the third fluid pressure cylinder 84, the plugs P stacked in a vertical row within 15 the chute 35 are allowed to fall one by one from the lowermost position of the row.

The ultrasonic sealer 37 has a body 91 provided with the sealing member 36 projecting therefrom leftward and in the form of a horizontal round bar termed a horn and 20 serving as an element for transmitting ultrasonic waves. The sealer body 91 is supported by a slide guide member 93 on a transverse guide rail 94. A leftward fourth fluid pressure cylinder 95 has a piston rod connected to the right end of the sealer body 91. A cavity 96 opened 25 leftward for the cap K to advance thereinto is formed in

the left end of the sealing member 36.

The rotary shaft 31 is driven into counterclockwise rotation by the servomotor 52 when seen from the right side thereof. The shaft 31 is halted only when the anvil 5 33 is brought into the vertical downward sealing posture, and is held in rotation except when the anvil 33 is in this posture. Accordingly, the anvil 33 is not halted when in the supply posture, moving past the chute delivery opening 34 from the front rearward at the left side 10 thereof.

The container C is moved forward toward the sealing station. When moving toward the sealing posture, the anvil 33 is moved so as to rotate counterclockwise in the manner shown in FIG. 4 in sequence. The container and the 15 anvil are moved as timed to avoid interference therebetween. When the container C is eventually brought to the sealing station, the outer end of the anvil 33 is inserted into the upper-end opening of the container C, and the projection 61 of the anvil 33 and the cavity 96 of 20 the sealing member 36 are positioned on a line through the container outlet O.

When the second fluid pressure cylinder 72 advances its piston rod before the anvil 33 rotating upward from the sealing posture moves past the chute delivery opening 25 34, the pushing-out member 62 moves leftward, holding by

suction the top of the cap K of the plug P at the lowermost position within the chute 35. In this state, the opening of the plug trunk wall L faces toward the same leftwardly forward oblique direction as the suction face

5 73. The pushing-out member 62 is further moved leftward in this state to deliver the plug P from the opening 34 and advance the plug to a standby position in the path of movement of the projection 61. When the upwardly rotating anvil 33 moves past the chute delivery opening 34 at the  
10 left side thereof, the plug trunk wall L is fitted around the projection 61. This movement is shown in FIG. 5 in sequence. First, the projection 61 engages with the rear edge of the plug trunk wall L defining the opening thereof as seen in FIG. 5(b). When the anvil 33 subsequently  
15 moves rearward as shown in FIG. 5(c), the plug P is also moved in the same direction slidingly on the suction face 73 along with the projection 61. The suction face 73 pushes the top of the cap K of the moving plug P, whereby the trunk wall L of the pushed plug P is fitted around the  
20 projection 61 gradually to a greater depth. The wall L is eventually fitted around the projection 61 completely and retained thereon as seen in FIG. 5(d).

The plug P moves along with the projection 61 while being guided by the guide member 64. This ensures  
25 stabilized delivery of the plug P to the anvil 33,

obviating the likelihood that the plug P will inadvertently slip off the projection 61. However, the guide member 64 need not always be provided.

The anvil 33 holding the plug P on the projection 61 5 rotates from the supply posture to the sealing posture. When brought into the sealing posture, the anvil 33 is halted from rotation, whereupon the first fluid pressure cylinder 45 operates to move the anvil 33 rightward and fit the plug cap K into the outlet O of the container C 10 waiting in position. The sealing member 36 is then moved leftward by the operation of the fourth fluid pressure cylinder 95, pressing the edge portion defining the cavity 96 against the clamping face 32, with the container edge portion defining the outlet O and the flange F interposed 15 therebetween. Ultrasonic waves are produced in this state to seal the outlet-defining edge portion with the flange F.

FIG. 9 shows an anvil 33 which has a constricted portion 65 provided at an intermediate portion of its 20 length by forming a circular-arc recessed part 66 in each of its front and rear opposite sides. The anvil thus constructed can be inserted into the container more easily without interfering therewith.

The embodiment described above is used in the case 25 where containers are transported intermittently a distance

at a time which distance corresponds to one pitch of containers as arranged for feeding. The embodiment to be described below is adapted for use in the case where containers are transported two pitches at a time.

5 FIG. 7 shows two rotary shafts 31 as arranged in parallel. Each of these shafts 31 is the same as the one included in the first embodiment. The pitch  $P_1$  of the rotary shafts 31 is equal to the pitch  $P_2$  of adjacent containers C as arranged for transport on the conveyor  
10 11. An anvil 101 is attached to the right end of each rotary shaft 31.

The anvil 101 has a clamping face 102 which is also provided with a projection 103 at the position of the same radius of gyration as the projection 61 on the straight  
15 anvil 33 used in the case of the single-pitch transport.

The anvil 101 has the same length as the straight anvil 33; whereas if two straight anvils 33 are used in the present case, one anvil 33 will interfere with the other anvil 33. To avoid this, the anvil 101 is in a bent  
20 form as will be described below in detail.

The anvil 101 comprises a base end portion 111 fixed to the rotary shaft 31, an outer end portion 112 provided with the projection 103, and an intermediate portion 113 between the base end portion 111 and the outer end portion  
25 112. The outer end portion 112 is offset from the base

end portion 111 rightward along the axis of the shaft 31 by a distance slightly greater than the distance corresponding to the thickness  $T$  of the base end portion 111 by a small distance  $\epsilon$ .

5 FIG. 8 shows in sequence how the outer ends of the anvils 101 are inserted into respective containers C brought to the sealing station in the case where the two rotary shafts 31 and two anvils 101 are used. The two containers are transported on the conveyor 11 by two  
10 pitches at a time. The two shafts 31 are driven in synchronism. The two anvils are rotated in the same phase.

When two rotary shafts 31 and anvils 101 are used in the case where two containers are fed at a time to the  
15 sealing station by two pitches, two containers C can be moved at a time along with the anvils 101 at the same timing as in the case of single-pitch transport of containers C. This is also true in the case where containers are fed by three or more pitches at a time.

20 In the case where containers are fed intermittently by more than one pitch at a time, the rotary shafts and anvils used are equal in number to the number of pitches, and the same number of chutes, as well as the same number of ultrasonic sealers 37, are of course used.

25 Instead of using the two rotary shafts as described

above, an arrangement may be used wherein two anvils 122 as positioned at an angle with each other are mounted on a single rotary shaft 121 as shown in FIG. 10. The two anvils 122 have respective projections 123 which are arranged with the same pitch as the pitch for feeding a single container at a time.

Furthermore, the position where plugs are fed to the anvil can be any location on the path of movement of the projection. The anvil may be halted when to be supplied 10 with the plug. The suction face 73 then need not always face toward an oblique direction but can be positioned in parallel to the path of movement of the projection.